THE CONVERSATION

Reclaim the inventive spirit of James Watt for an energy-rich, lower-carbon world

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With one invention James Watt blasted the UK 60 years into the future. James Eckford Lauder, 1855

Some 250 years ago James Watt, then scientific instrument maker to the University of Glasgow, devised the separate steam condenser while ambling through Glasgow Green one spring morning in May 1765. If any single moment can be traced to the rise of fossil fuel consumption then it's surely this.

Watt's quite brilliant insight was to improve the efficiency of steam power three-fold, arguably pushing Britain 60 years into the future. But not only could Watt's new machine replace human labour in production, it could efficiently pump water from mines, thereby accelerating the extraction and consumption of coal. What was still mostly a boutique fuel for 18th-century industry and heating would become the fuel of choice to power industrial Britain in the late 19th and early 20th centuries.

Now, due to the 21st-century climate risks associated with long-term fossil fuel consumption, the divestment movement is urging institutions to pull their investments from the fossil fuel industry. But those most vocal in calling for a blanket divestment from all fossil fuels often ignore the nuances of prior energy transitions, underestimate the scale of the challenge and some even oppose the growth of proven low-carbon technologies such as nuclear power.

If climate is the issue and carbon is the problem, then it's perhaps surprising that our energy economy has actually been decarbonising in relative terms for centuries. Not all fuels are alike, and historical energy transitions from wood to coal and then through oil, methane and nuclear have led to a steady fall in the amount of carbon emitted per unit of energy delivered.

The underlying connection between these prior energy transitions has been a steady increase in the energy density of fuels, for example from carbon-rich coal to hydrogen-rich methane, which packs a greater energy punch weight-for-weight. Of course accumulated emissions have grown steadily during this period, but that's due to the tight link between economic growth and energy consumption during rapid industrialisation.

Energy-dense nuclear fuel means lots of low carbon energy.
Graeme Maclean, CC BY

A pragmatic energy policy would therefore build on an acceleration of these historical long-waves of improving energy density. Such a programme would feature a large-scale shift from carbon-rich coal to hydrogen-rich methane and carbon-free nuclear, both of which can provide power on demand.

Although renewables will no doubt play a significant role in the future, they are diffuse and so have a poor power density and work only intermittently, bucking the long-term historical trend. While nuclear can often directly replace coal, wind and solar still require fossil-fuelled plants to ensure electricity keeps flowing on still, cloudy days.

Industrial-scale batteries or other energy storage systems can be a partial solution, but they're an additional capital cost to deal with intermittency and the scale of storage required is immense.

But changes can also come from within the fossil-fuel industry itself. Only the oil and gas industry has both the capital and the engineering expertise to make coal cleaner through carbon capture and storage or partly replace carbon-rich coal with hydrogen-rich methane. Indeed moving from coal to methane as a fuel of choice is one of the easiest and most cost-effective energy transitions we could make in the near-term. This can clearly be seen through the significant decline in US emissions in recent years, which is largely due to cheap shale gas displacing coal.

Questions for divesters

The very real success of the US shale gas industry in both economic and emission terms exposes a problem for the uncompromising position on all fossil fuels taken by the divestment movement.

In terms of actual real-world divestment actions, it's worth noting that Norway's vast sovereign wealth fund has adjusted the spread of its energy portfolio, entirely divesting from coal but making careful reinvestments in oil and gas. Similarly, Shell's recent acquisition of natural gas company BG Group underlines the push to replace coal with gas, following the long historical trend from carbon-rich to hydrogen-rich fuels.

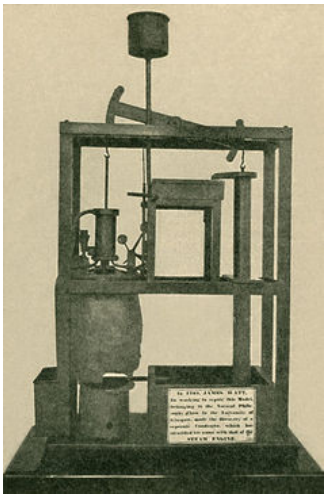
The divestment movement also needs to deal head-on with its often highly contradictory views on nuclear energy. Veteran climate scientist Jim Hansen states that believing in a rapid transition away from fossil fuels using renewables alone is akin to "believing in the Easter Bunny". He also slates many of the leading environmental groups as being one of the greatest obstacles to emission reductions due to their uncompromising anti-nuclear stance.

Simultaneously campaigning for divestment from all fossil fuels and an end to low-carbon nuclear energy reveals that, for some at least, the divest campaign is not simply about climate, it's about a much broader agenda.

Investing in energy innovation

If we're serious about reducing carbon while delivering modern energy services for all, we need to focus on innovation. We should remember that when James Watt's efficient new steam engine began to displace Thomas Newcomen's earlier machine, it didn't require top-down political targets or state incentives to encourage the take-up of the new technology. Watt's idea succeeded simply because it required only one third as much coal to deliver the same quantity of mechanical work.

If we can develop cheaper, cleaner alternatives to fossil fuels over the coming decades which are truly scalable, then the subsequent fall in energy prices will reach our fellow citizens in the developing nations living with the impacts of permanent energy austerity and as a side effect the climate problem will ultimately solve itself.



Watt's eureka moment came when repairing this Newcomen engine. Hunterian Museum, Univ. of Glasgow

Finally, as we look to the future from the 250th anniversary of James Watt's invention, we quickly need to rediscover his enlightenment-era inventiveness and reclaim the notion of a progressive, human-centred future. In the long twilight of the wood-burning era before James Watt we worked for energy, but now energy works for us, freeing us to pursue all that is good in our modern civilisation.

We also need to be clear that in the long-term, the deeply intertwined issues of energy and climate won't be solved by climate science; they will be solved by engineering science, while global energy poverty will be solved by deflating, not inflating energy prices.

James Watt's initial is stamped on every light bulb, measuring the power it delivers, but also reminding us of the intellectual light and sheer progress he brought to the world. Rather than obsess over the symbolism of divestment, this is what we need to invest in.

Fossil fuels
Engineering
Innovation
Invention